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ABSTRACT

This paper explains the Head Start on Science and Communication Program (HSSCP) developed by the Laboratory of Student Success (LSS) at Temple University Center for Research in Human Development and Education (CRHDE). This program uses an inquiry approach and teaches problem solving skills to students. The program consists of a 2-week summer training period at the beginning of the program, post-training classroom surveys, in-class technical assistance, and modeling of experiments during the school year. The outcome of the study indicates that changes in teaching methods and classroom structure occurred. (Contains 13 references.) (YDS)

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INTRODUCTION

In response to the critical need for effective learning models within the nation's school systems, there have been a number of conceptual changes in classroom curriculum. These changes have led to the development of new curriculum frameworks and classroom practices. The new models for learning emphasize learning as an interpretive process. The students are taught specifically to view the world in a continuous social and cognitive process of changing ideas, describing and communicating them as they make sense of their own learning, drawing from prior knowledge, past experience, and using inquiry as a process to acquire information.

In an effort to cultivate science literacy development among preschool children in Head Start programs, the principal investigators at the Laboratory of Student Success developed the Head Start on Science and Communication Program to include the efforts of parents, teachers, and classroom assistants. The program, creating a science-rich learning environment, emphasized an inquiry approach to broadening young students' science knowledge.

THE PROGRAM

The principal investigators from the Laboratory for Student Success (LSS) at Temple University Center for Research in Human Development and Education (CRHDE) designed and implemented the Head Start on Science and Communication (HSSC) Program as a field-based professional delivery system. The program designers set out to train as well as provide technical assistance to the involved parents, teachers, and classroom assistants. The training from LSS staff members was designed to achieve two main objectives: broaden participants' science knowledge and initiate an effort to structure preschool learning environments with effective communication as the foundation. At the start of this program, a two-week summer training took place. This was followed by post-training classroom surveys, in-class technical assistance, and modeling of experiments during the school year.

Through an inquiry approach to learning, students were also taught effective problem-solving skills. The researchers from LSS outlined three specific objectives for the HSSC program:

- broaden participants' science knowledge and conceptions around three science domains: life science, earth science, and physical science;
- enhance age-appropriate abilities to use a scientific inquiry approach to learning with processing skills such as observing, hypothesizing, predicting, investigating, interpreting, and drawing conclusions; and
- integrate the HSSC Program with the core curriculum so that preschool children are able to actively engage in their preschool learning experience at home.

Subjects

The HSSC training group participants consisted of 18 teachers, 10 parents and 11 classroom assistants, ranging in age from 19 to 53 years, and females representing 97% of the population. The group was made up of three different ethnicities: 68% African-American, 29% Caucasian, and 3% Latino. Of the Head Start programs represented, 85% were based in large urban settings, while 15% were from suburban or rural settings.

The educational level of the group receiving training was diverse. Some of the group members held a GED (graduate equivalency diploma) and others had a master's degree. Those participants who had attained a high school diploma or GED counted for 28% of the training group. The group members that had received a diploma and some early childhood education also counted for 28%. The classroom assistants with associate's degrees comprised 5% of the group's make-up. Among the teachers, 18% had bachelor's degrees and 21% had a master's degree. None of the parents had college degrees.

Including parents in the learning process was a critical element to the success of the program. The links between what a child learns at school and how learning is reinforced outside school is key to a child's success in learning. Inclusion of parents encouraged the learning process to continue. The training involved parents as well as teachers. Parents also reported that the skills learned in the summer course helped improve their parenting skills. Essentially, that training involved use of collaborative science experiments based on structured lessons for which teacher, classroom assistants, and parents were taught to use an inquiry method of problem-solving.

Procedures

During a two-week session in August 1996, Head Start participants were involved in training for the HSSC program implementation. The group involved 39 participants representing Head Start programs from 12 schools throughout Philadelphia.

At the beginning of the school year, a sample of 12 participating Head Start programs expressed interest in the program and completed program evaluations. The programs were surveyed for critical features of classroom communication, specifically inquiry as a means of encouraging children to ask questions and search for an answer rather than just being told the information. Teachers, parents, and classroom assistants were assessed as either encouraging inquiry to gain information and solve problems or "giving-away" answers. In addition, classrooms were surveyed for their primary mode of interaction as being generally collaborative or competitive.

In a post-implementation survey, 17% of the teachers stated they would tell students the answers as opposed to encouraging problem-solving and discovery in the classroom setting, 50% encouraged problem-solving, and 33% said they tended to do both. Of the parents who chose to answer the questionnaire (n=10), 17% or one-third said they would tell their children the answers.

The majority of parents engaged in both encouraging problem-solving through inquiry as well as giving answers. Almost half of the classroom assistants (42% of the 11 subjects) told the students answers to classroom work. They did not initially foster an inquiring learning approach. Only 17% of the assistants encouraged the students to problem-solve. Twenty-five percent of the classroom assistants encouraged both problem-solving and telling students the answers when necessary, and 16% did not respond to the survey (see Figure 1). The total percentages of adults encouraging problem-solving skills of some form were as follows: 83% of the teachers, 42% of the classroom assistants and 83% of the parents. In summary, it appeared that classroom assistants gave away more answers to students as compared to teachers and parents who encouraged more problem-solving through questioning.

Post- implementation surveys also indicated whether each class engaged in collaborative or competitive modes of interaction. Eight classes were assessed as being primarily collaborative where students worked together as part of a team. Three of the classrooms surveyed engaged in tasks that were both collaborative and competitive. Only one was termed solely competitive (see Figure 2). Collaborative interactions included working together on projects with students assuming varied and complementary roles, such as recorder, facilitator, researcher, etc. Classroom characteristics included listening, waiting, acknowledging comments, inviting questions, accepting other points of views, and encouraging students to express ideas. Competitive interactions included playing games with a winner or preparing individualized work with a grade attached.

RESULTS AND DISCUSSION

Teachers of the program reported they changed their classroom focus to primarily use an inquiry method. The participants began to use open-ended questioning with their students. Instead of asking yes-no type questions, they asked wh-type questions (who, what, where, when, why,

and how). Participants reported that children were encouraged to ask both factual and inferential questions, also using what, why, and how forms to obtain information about outcomes observed.

Participants noted a change in the classroom structure. Some teachers set up art centers and other explorative learning centers within the classroom setting. The participants noted that using literature became a focal point of all the classroom activity. Other teachers used parent involvement as a way to reinforce classroom learning. Teachers sent letters to parents explaining what would be discussed in class and encouraged parents to visit the class. Teachers and assistants agreed that language use and vocabulary were definitely an integral part of the learning process.

School participants had a number of ideas for the future of the Head Start on Science and Communication program. One teacher planned to meet with the entire faculty to "brainstorm" possible questions to be used to encourage communication skills for the science experiments—questions that tapped more inferential thinking. Another faculty member looked forward to involving parents, noting that parental involvement is a key to the success of the implementation of the program as well as its continuity. The teachers looked forward to implementing the techniques and utilizing these ideas immediately.

At program completion, evaluation of the teachers' perceptions regarding implementation revealed that 100% of the teachers were satisfied with the Head Start on Science and Communication program. On a scale of *1* to *3* (from little benefit to definite benefit), all 12 primary classroom teachers rated the HSSC program as *3* (see Figure 3). The training program involved teachers and classroom assistants in the restructuring of classroom interaction. Some teachers emphasized introducing the children to literature on a daily basis. The teachers determined that students could easily make the connection between a story and the science

experiment. By program completion, teachers believed they were making a difference in the children's scope of cause/effect thinking and the ability to ask questions for interaction and new information.

Teaching assistants benefited from learning more about inquiry as a method to stimulate children's inferential thinking. Through the use of this interactive inquiry approach to problem-solving with the science curriculum in the Head Start preschool programs, the teachers determined that classroom assistants were asking more open-ended questions and that the children had increased their use of inquiry for learning.

Due to the success of phase one, the program has expanded into phase two, from preschool age children (Head Start) to those in early elementary years (second grade). This phase was expanded to follow the national science standards for children from kindergarten through grade two, and includes a standards-based science curriculum that encompasses life, earth, and physical sciences. Embedded in the science activities are developmentally-based questions ranging from factual knowledge for recall to inferential skills required for problem-solving skills.

RELATED PUBLICATIONS

National Center for Improving Science Education. (1989). *Getting started in science: A blueprint for elementary school science education.* Andover, MA: The Network, Inc.

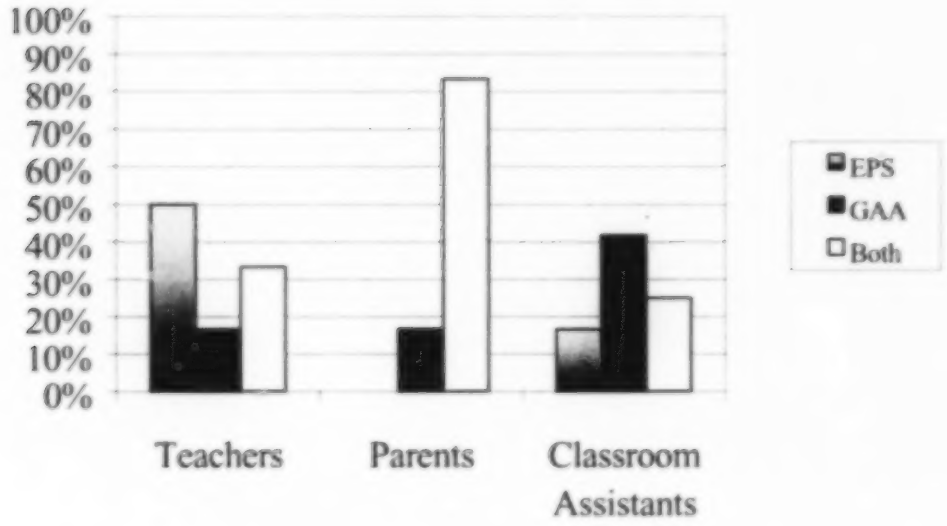
National Council for Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: National Council for Teachers of Mathematics, Inc.

Tobin, K., Tippins, D. J., & Gallard, A. J. (1994). Research on instructional strategies for teaching science. In D. L. Gabel (Ed.), *Handbook of research on science teaching* (pp.45-93). New York: Macmillan.

U.S. Department of Education. (1993). *State of the art: Transforming ideas for teachering and learning science.* Washington, DC: Author.

Zigler, E., & Styfco, S. J. (Eds.). (1993). *Head Start and beyond: A national plan for extended childhood intervention.* New Haven, CT: Yale University Press.

Figure 1. Post-Implementation Survey of Problem-Solving Methods

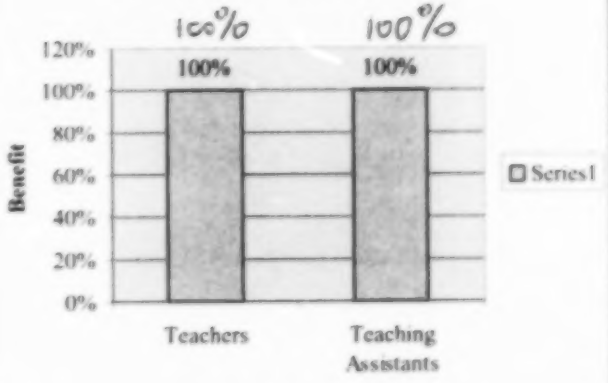


EPS = Encourage Problem-Solving Skills
GAA = "Give-Away" Answers
Both = EPS and GAA

- 50% of teachers encouraged problem solving without giving away any answers, 17 % gave away answers, and 33% engaged in a combination of both encouragement and give-aways
- 13% of parents gave away answers, while 87% used a combination of both
- 17% of classroom assistants encouraged problem-solving, 42% gave away answers, and 25% used a combination of both
  (16% of classroom assistants did not respond to the survey)

Figure 2. Post-Implementation Survey of Classroom Interaction Style

Figure 3. End-of-Program Benefit to Teachers and Teaching Assistants



At completion, 100% of teachers and teaching assistants surveyed found the HSSC training program to provide definite benefit to classroom interaction using an inquiry approach.

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